

# **‘One Medicine – One Health’ at the School of Veterinary Medicine of the University of Pennsylvania – the first 125 years**

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## **Summary**

The University of Pennsylvania’s School of Veterinary Medicine (Penn Vet), in partnership with other veterinary schools and health professions, is positioned well to advance an international ‘One Medicine – One Health’ initiative. Founded in 1884 by the University’s Medical Faculty, the School has been a leader in moulding the education and practice of veterinary medicine in the nation and the world. Successfully integrating biomedical research into all aspects of veterinary medical education, the School has made significant contributions to basic and clinical research by exemplifying ‘One Medicine’. In looking to the future, Penn Vet will embrace the broader ‘One Health’ mission as well.

## **Keywords**

History, Medicine, One Health, One Medicine, Public health, University of Pennsylvania, Veterinarian.

## **“Una sola medicina – Una sola salute” alla Scuola di Medicina Veterinaria dell’Università della Pennsylvania: i primi 125 anni**

### **Riassunto**

*La Scuola di Medicina Veterinaria dell’Università della Pennsylvania (Penn Vet), in collaborazione con altre scuole veterinarie e professionisti del campo, vanta ottime credenziali per portare avanti l’iniziativa “Una sola medicina – Una sola salute” a livello internazionale. Fondata nel 1884 dalla Facoltà di Medicina dell’Università, Penn Vet è stata una delle prime “fucine” di formazione e pratica della medicina veterinaria negli Stati Uniti e nel mondo. Attraverso la sapiente integrazione della ricerca biomedica in tutti gli aspetti della formazione veterinaria, la Scuola ha contribuito in misura significativa alla ricerca clinica e di base, esemplificando il concetto di “Una sola medicina”. In futuro, Penn Vet si dedicherà anche alla più ampia mission “Una sola salute”.*

### **Parole chiave**

Medicina, Salute pubblica, Storia, Università della Pennsylvania, Una sola medicina, Una sola salute, Veterinaria.

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## Genesis: 1807 to the School's founding and early years

Even in the first decade of the 19th century, as University of Pennsylvania authorities were weighing up the possibility of adding a veterinary school, discussions focused on the concept that disease processes in man and animals are fundamentally similar, that there is but 'One Medicine'.

In 1807, in an introductory lecture to a Medical School class, Benjamin Rush, a signatory to the Declaration of Independence, Philadelphia's most eminent physician and a member of the venerable Philadelphia Society for Promoting Agriculture, proposed the establishment in the University of a Veterinary Chair (Fig. 1). His lecture, entitled *On the duty and advantages of studying the diseases of domestic animals and the remedies proper to remove them*, advanced the following reasons:

- 'the absurd, painful and destructive treatment to which they were subjected when diseased, by uniformed misinformed but well-meaning individuals
- the gratitude we owe them for the service and materials they furnish
- to guard against the spread of diseases from them to man through the food products they supply
- to prevent the extensive losses of animals and their products by epidemics of destructive diseases
- to add greatly to the certainty and usefulness of the profession of medicine as their morbid effects, being the same as in the human body, and most medicines producing in them and in us nearly a similar operation
- and, finally, the precepts in the Old and New Testament which recommend kindness to them and protection from outrage and oppression.
- By acquiring this kind of knowledge and by disseminating it gratuitously in your neighbourhood, you will become the benefactors of your country' (2).

Despite Dr Rush's eloquent and prescient appeal, seventy-seven years were to pass before the University Trustees acted to establish a veterinary school. On the occasion

of the Veterinary School's centennial celebration in 1984, Alexander Rush, an emeritus clinical professor at Penn's Medical School, in a commentary on his great-great grandfather's seminal lecture, entitled *Benjamin Rush, he aimed well*, wrote:

- 'Little, until now, has been written about that target which he singled out in his "Lecture on the advantages of knowledge of the diseases of domestic animals", delivered on November 2, 1807... to his medical students wherein he recommends the inclusion of a course in veterinary science in the curriculum of every medical school.
- That he did indeed aim well becomes abundantly clear...veterinary medicine [advanced] from its uncertain beginnings to its eventual recognition as a *bona fide* scientific medical discipline.... Dr Rush's words found their mark and led to a productive relationship between the University of Pennsylvania School of Medicine and its younger sister, the School of Veterinary Medicine' (2).



Figure 1  
Dr Benjamin Rush was a signatory of the Declaration of Independence, a founder of the nation's first medical school at the University of Pennsylvania and a visionary proponent of comparative medicine  
Courtesy: Archives of the University of Pennsylvania

In the years immediately following Dr Rush's lecture, other members of the Philadelphia Society for Promoting Agriculture continued to show concern for improving methods of

preventing and treating diseases of animals. Dr James Mease, Secretary of the Society, gave a series of lectures on diseases of domestic animals and wrote papers on rabies, Texas fever and ergot poisoning. However, the spark that eventually led to the creation of a veterinary school at the University of Pennsylvania was ignited in 1877, when Horace Smith, an alumnus of the University, initiated a vigorous campaign for this purpose. Smith, distressed by the woeful lack of competent veterinary services, managed a large farm which cared for fine carriage horses. In a hand-written letter to Dr William Pepper, Professor of Clinical Medicine (and later University Provost), he asked whether the Trustees and Medical Faculty 'would be likely to approve of having a chair of veterinary science established in connection with the University of Pennsylvania' (Fig. 2).

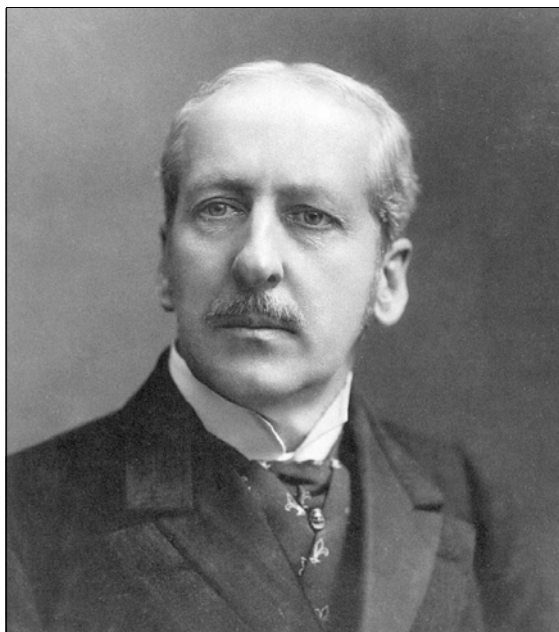


Figure 2  
Dr William Pepper was Provost of the University of Pennsylvania when the School of Veterinary Medicine was founded  
Courtesy: Archives of the University of Pennsylvania

Smith's letter, read to the Medical Faculty in November 1877, resulted in a resolution stating that it would be 'desirable to establish a Professorship of Veterinary Medicine and Surgery whenever a suitable endowment can be procured for this purpose'.

However, the financial problem remained until 1882, when Joshua B. Lippincott informed the Trustees that he would donate US\$10 000 to an endowment fund for a Veterinary Department at the University (Fig. 3). In response, a committee recommended to the Trustees that 'the initial faculty of the new department include two professors and instructors common to all branches of medicine (e.g. anatomy, chemistry, and *materia medica*)'. In these basic subjects, veterinary students would be taught with medical students 'in the same manner as is now done in the case of dental students'. Upon Trustee approval for a Veterinary Department, a search for a Dean culminated, on 3 April 1883, in the selection of Rush Shippen Huidekoper (Fig. 4). He was named Professor of Internal Pathology and Contagious Diseases and Dean of the Veterinary Faculty.

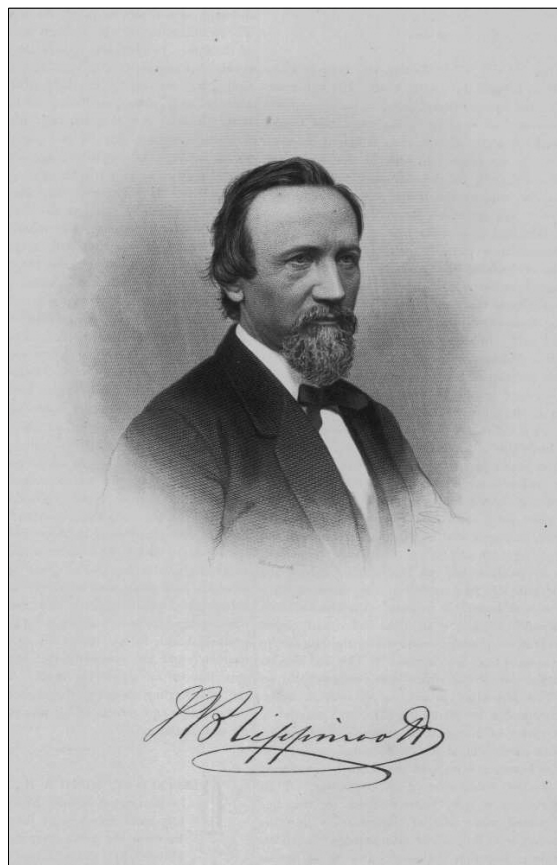


Figure 3  
Joshua B. Lippincott provided the US\$10 000 gift that enabled the founding of Penn Vet  
Courtesy: Archives of the University of Pennsylvania

Huidekoper was endowed with an auspicious lineage; his ancestors included Benjamin Rush and Edward Shippen, Philadelphia's first mayor. He was a graduate of the University's Medical Department where he had trained under the famous surgeon, D. Hayes Agnew. Following medical school, Huidekoper, an avid horseman, travelled to France and qualified for a veterinary degree at Maisons-Alfort. He enhanced his training by visiting veterinary schools in Lyons, Berlin, Vienna and Italy, becoming well versed in European methods of education. Upon being named Dean, he travelled to Europe to visit the laboratories of Koch, Virchow and Pasteur.



Figure 4  
Dr Rush Shippen Huidekoper, a descendent of Benjamin Rush, was the first Dean of Penn Vet  
This photograph was taken by Eadweard Muybridge on the campus  
Huidekoper was an accomplished horseman and Muybridge was committed to the study of animals in motion, completing many of his pioneering photographic studies near the present location of the School of Veterinary Medicine  
Photo: Eadweard Muybridge  
Courtesy: Archives of the University of Pennsylvania

The stated aims of the new School embodied what were to become its guiding principles, as follows:

- 'This department aims to give instruction, both theoretical and practical, in all branches pertaining to the scientific study of the elements of medicine, and the practical application of these elements to the domestic animals, in the preservation of their health, in their employment as useful aids to man, and in the disease to which they are subject' (1).

Thus, from the very outset, the School was identified as a branch of a common medicine, but with particular responsibilities to agriculture and animal owners, and for the general welfare of animals.

The composition of the original faculty of twelve, including Huidekoper, reflected the new School's close association with the University's Medical School. Ten were MDs; two had only veterinary degrees. A three-year course was prescribed, with annual sessions of nine months each. Graduates received a VMD (*Veterinariae Medicinae Doctoris*) degree, although the University had originally planned to confer a VS (*Veterinary Surgeon*) degree. There appears to be no record of why this change was made, but it is generally believed that it was intended to emphasise the Veterinary Department's close association with the Medical Department. Today, the University of Pennsylvania remains the only American university to confer a VMD, rather than a DVM degree.

The early curriculum and the method of teaching were influenced by Dean Huidekoper's experience at European schools, but the guiding force at Penn was the University's Medical Department. The new Veterinary Department lacked other models to inform its development as there were only two other North American veterinary schools associated with a college or university – Iowa State College and Harvard University – and there is no evidence of a meaningful exchange of information between them. Today, Iowa State has the only other veterinary school extant that was established before the University of Pennsylvania. It is revealing to compare the mission statements and faculty profiles of the nascent veterinary schools at Penn and Iowa State. As described in a fiftieth anniversary history of the Iowa Veterinary School, President Welch, in 1871, stated that his School's purpose was purely to serve agriculture, and that '{T}he agricultural course will need a professor of practical agriculture'. Moreover, when courses in veterinary science were added 'there was a great cry among agricultural editors and agricultural politicians that the college was drifting away from the



original intent of the founders and becoming a scientific and literary institution' (3) The contrast between Penn's 'One Medicine' and Iowa's 'agricultural' origins and orientation is striking.

In 1884, when the new Veterinary School accepted its first class, the United States was making great strides in industrialisation, but its economy was largely agricultural. There was thus a compelling need for well-trained veterinarians; an estimated 500 cared for the nation's estimated 175 million livestock. Many practitioners had minimal training; others simply adopted the title of veterinarian without any formal education. As veterinarians were not held in high esteem, there was an urgent need to enhance the profession's image by adopting high educational standards. Dean Huidekoper lamented the fact that the school must immediately 'contend with the prejudice which ignorance has attached to veterinary surgeons as a class and with the reluctance which aspirants for this title feel, in offering to devote a long period of work to gain that which their neighbor, the farrier, acquired the day he opened a suppurating corn in a lame horse and sent it home sound, or the cow-leech took to himself when he gave some herb to a cow down with milk fever and she recovered, as they sometimes do by the aid of nature'.

Initially, veterinary students took their basic science courses with medical students in the University's Medical Department. However, between 1910, when the Veterinary Department officially became the School of Veterinary Medicine, and 1930, the School acquired its own full spectrum of basic science departments.

The Veterinary School's reputation for excellence in research may be said to have its origins during the latter part of the 19th century. In 1891, Dr Leonard Pearson, the School's third Dean, performed the first practical tuberculin test in America on a large Jersey herd, the forerunner of a national programme to control bovine tuberculosis. He also introduced the mullein test for equine glanders and published studies on forage

poisoning, osteoporosis and foot and mouth disease (Figs 5 and 6).



Figure 5  
Dr Leonard Pearson was the third Dean of Penn Vet and a pioneer and innovator in veterinary science  
Courtesy: Archives of the University of Pennsylvania

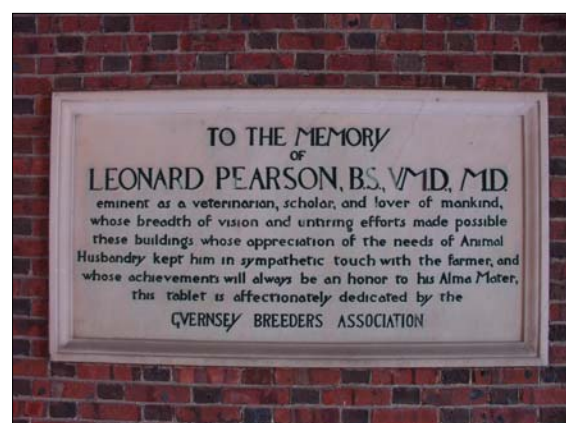


Figure 6  
A plaque dedicated to Dr Leonard Pearson is in the entrance to the School's Old Veterinary Quadrangle building  
Photo: John Donges

## The renaissance: 1953 to the present

By 1953, as the nation's only veterinary school rooted in a private university and with little or no financial support from the Commonwealth of Pennsylvania, the School's fortunes had gradually waned. Two major factors confronted the School in the 1950s. The transformation from horse-driven to automobile-driven transportation had occasioned the collapse of most of the schools of veterinary medicine that had been present at the time of Penn Vet's founding. This was a general transformation worldwide and eventually shifted the profession's focus towards medical services for companion animals, in addition to its traditional large animal focus. The second, specific to Penn Vet, was that the location of the School in West Philadelphia forced a decision whether to make a major investment in another location to allow the School to continue to provide a venue for students to work with large animals – both horses and farm animals. The nation was undergoing the Green Revolution that concentrated agriculture in relatively fewer, more intensive farms and the population was becoming more urban. The numbers of veterinarians needed to attend to farm animals began a decline that continues to the present day. Furthermore, the School was chronically under-staffed and under-funded, with an inadequate and deteriorating physical plant, the School faced an existential crisis. These dire circumstances led Mark Allam, the School's newly appointed eighth Dean, to convene a small group of senior faculty and to posit for their consideration 'whether or not the School should continue to exist or, with University Trustee approval, should be phased out'. The response was a resounding vote to continue and, expressing confidence in Dean Allam's enlightened and high-spirited leadership, the group resolved to work together to reinvigorate the School and with deliberate speed to propel it forward on a path towards excellence in every department. The Dean's 'unofficial master plan' emphasised faculty and physical development as well as the

integration of teaching, research and patient care, and he was soon engaged in an unprecedented fund-raising effort aimed at constituencies in the public and private sectors. Dean Mark Allam's charm, energy, openness to risk, boundary-crossing and new initiatives convinced his faculty that Penn was poised to transform veterinary medical education and practice in the nation and the world.

The optimism that informed the historic decision to continue the School with an accelerated agenda for achieving excellence was based on a rare conjunction of elements and circumstances, as follows:

- Penn was the only veterinary school that was an integral part of a great academic health centre in a city renowned for the scope and breadth of its biological and medical sciences and resources.
- In the post-World War II and post-Sputnik era, the Government of the United States was investing unprecedented amounts of money in biomedical education and scientific research.
- In such a favourable environment, the development of a first-rate basic science and clinical research enterprise, as well as a broad spectrum of authentic clinical specialties, seemed clearly achievable.
- By developing clinical specialties, coupled with a research-oriented clinical faculty in Penn's rich biological and medical environment, the Veterinary School had the potential to become a world leader in comparative medical research.
- The School's purchase in 1952 of a rural campus (New Bolton Center) in a prosperous agricultural region, would in time give the School the clinical and research resources for an outstanding large animal teaching and research programme. It was believed that because agriculture, particularly dairy farming, was Pennsylvania's largest industry, an excellent, highly visible veterinary school could not fail to attract substantial State and private sector support.

Thus, the trend clinical specialty development and clinical research at Penn built on history and captured the opportunities presented in

the 1950s. In the 1930s, Mack Emerson, trained in Vienna and in the Medical School's Department of Radiology at Penn, had established the specialty of veterinary radiology and, in the 1950s, David Detweiler and John McGrath, both trained by Medical School faculty, founded, respectively, veterinary and comparative cardiology and neurology as authentic clinical disciplines. Frantisek Kral, a Czech refugee appointed to the faculty in 1948, was acknowledged as America's first veterinary dermatologist and Mark Allam had received advanced surgical training in the Medical School's Harrison Department of Surgical Research. Basic science education at the professional level was carried out jointly with the medical school for approximately the first 80 years and much of the clinical training of the veterinary school faculty was also conducted in the medical school. It would seem that these early years embody 'One Medicine'. However, today, the basic science faculty and teaching are independent from the medical faculty, although research is still highly collaborative across the University, including the School of Medicine, Dentistry, Arts and Science, and Engineering. The decision to further develop the faculty of biomedical scientists began with Dean Mark Allam's strategic plan. Dean Allam and his successor, Dean Robert Marshak, began aggressively recruiting well-trained young veterinary scientists and formally promoting training of both clinicians and scientists at the School of Veterinary Medicine. Dean Allam originally recruited Bob Marshak, a Cornell graduate pursuing dairy practice who also had a profound interest in basic biomedical research, to become Chair of the Department of Medicine in 1956.

Those recruited during this period were fully aware they were part of a new vision of 'One Medicine' and many led the profession in the decades to come, as stellar biomedical investigators or as leaders.

Ralph Brinster, Richard King Mellon Professor of Reproductive Physiology and first Director of the Veterinary Scientist Training Program, one of these recruits, recalls: 'When I arrived... [a] few faculty...had a scientific/research

perspective, which they conveyed to the few students interested. This small group of faculty led by Mark Allam believed this was the future of veterinary medicine. Mark and several of these faculty had significant connections with faculty at the School of Medicine and developed plans together in what comprised the initial concept, of one medicine, which seems so obvious 50 years later. This nucleus of faculty revitalised the School and directed its future with key new additions, including Bob Marshak, Bob Davies and Lawson Soulsby. Then, these individuals began to recruit young faculty in basic science and clinical medicine who shared their vision of veterinary medicine with a strong foundation in scientific research and excellence in clinical specialties. Many of these young recruits, and I was one, received significant training along with their counterparts at the School of Medicine, thus reinforcing the growing concept of one medicine. This training at a first-class university with a superb graduate school and school of medicine was unique in veterinary education. However, just as important as the training opportunities were the enthusiasm and belief that in this environment, with the excellent talent among students, that veterinary medicine could be transformed. As the cadre of research scientists and clinical specialists grew, the School of Veterinary Medicine took its place alongside the other excellent schools at Penn, and cemented the concept and existence of one medicine. The evolution of basic science research and clinical specialties at the School resulted in it becoming a model for a new class of veterinary schools in this country and throughout the world'.

A distinguished cell biologist and pioneer in mammalian transgenesis, Brinster, who also received his veterinary and PhD degrees from Penn, is a member of the National Academy of Sciences and recipient of many of the most prestigious prizes in biology and medicine. A recent example of Penn's *one medicine model* is the joint role of Brinster and Medical School Professor Jonathan Epstein as founding co-directors of the University's new Institute for Regenerative Medicine.

In 1956, Harker Rhodes (radiology) and Robert Brodey (surgery and surgical pathology) were in training in the University's graduate School of Medicine. Subsequently, over the years, a host of talented young veterinarians were trained and recruited to establish the School's full spectrum of specialties, namely: anaesthesiology, ophthalmology, oncology, a multiplicity of medical and surgical subspecialties, medical genetics, critical care and emergency medicine, theriogenology, dentistry, clinical pathology, epidemiology and biostatistics, laboratory animal medicine, an animal behaviour clinic and aquatic veterinary medicine.

The plan for broadening the School's spectrum of specialties, implemented in 1956, was based, in the main, on recruiting recent veterinary school graduates, especially those with obvious academic potential, and arranging for their training, usually as residents, at the University's medical school hospitals or, if advantageous, at other biomedical institutions. Clinical training generally included a research component and/or was followed by training in an appropriate basic science discipline, e.g. anaesthesiology/pharmacology. Successful trainees were brought back to the Veterinary School, usually as instructors, with the expectation that they would establish their specialties by becoming full participants in the School's didactic and hospital clinical teaching programmes. Each was expected to establish a research programme by applying for grants and/or research career development awards from the National Institutes of Health (NIH) or other granting agencies. Most specialty trainees continued throughout their careers to associate and collaborate with their mentors and MD counterparts, and thereby to disseminate the 'One Medicine' gospel first articulated by Benjamin Rush in 1807.

The majority of the specialty training programmes were tailored to produce veterinarian-scientists, regardless of whether or not they culminated in the granting of a masters or PhD degree. In such a diversity of clinical fields, it was deemed that the quality, suitability and efficiency of a training programme in achieving the School's

particular objectives should supersede the constraints imposed by many degree granting programmes. It was noted that American medical school graduates, in preparing for academic careers, rarely elected the PhD route, preferring to train in high-quality research and residency programmes and publishing their work in top journals. Moreover, at Penn and at other elite American research universities, biomedical PhD programmes are restricted to non-clinical basic science disciplines. Ten programmes completed by Penn's clinical faculty ranged from anaesthesia to medical genetics to various areas of medicine and surgery, and only two led to a PhD. Four fellowship programmes led to no degree; the remainder culminated in master's level or other doctoral-level degrees. The decision, when advantageous, to bypass the degree-granting approach represented a new departure in preparing veterinarians for academic careers and was regarded with scepticism and misgivings by other veterinary schools. Today, the focus on the PhD as a prerequisite for academic or research positions remains a significant barrier. Adding a 6- to 7-year course of study to 8 years of undergraduate and professional training, with the desirable addition of post-doctoral clinical and research training, is a marathon of training. The question of how to provide cost-effective training for academia is discussed further below.

By the mid-1970s, when colleges formally recognised specialisation in veterinary medicine, Penn Vet was clearly in the lead in the national movement. As an example, among the 118 founding members of the American College of Veterinary Internal Medicine and its subspecialties in dermatology, neurology, oncology and cardiology, fully one in six were Penn Vet Faculty. In parallel with the growth in size, quality and diversity of the School's clinical enterprise was a vigorous effort to strengthen the School's two basic science departments, namely:

- animal biology, incorporating the laboratories of anatomy, biochemistry, physiology and pharmacology



- pathobiology, incorporating the laboratories of pathology, microbiology and parasitology.

Departmental chairmen were recruited following intensive international searches by committees with veterinary and medical school representation. Robert E. Davies, Fellow of the Royal Society, distinguished biochemist and molecular biologist, internationally renowned for research on muscle, accepted the Chair of Animal Biology in 1962. In 1970, the University honoured Davies with the prestigious Benjamin Franklin Professorship of Molecular Biology. In 1973, Davies was succeeded by Leon Weiss, a physician, recruited from Johns Hopkins University. An eminent histologist and electron microscopist, Weiss was a world authority on the functional anatomy of the hematopoietic system. In 1964, E.J.L. Soulsby, now Lord Soulsby, was recruited from Cambridge University to occupy the Chair of Pathobiology. Soulsby was renowned for his research on the immunology of parasitic infections and had authored an acclaimed textbook on veterinary parasitology. Lord Soulsby recalls, 'On my translocation from Cambridge to Philadelphia [in 1964], I found exciting developments in the field of one medicine in the Veterinary School, for example in cardiology and bovine leukaemia but particularly I was impressed by the collaboration across the departments, not only in the Veterinary School but also the University of Pennsylvania and its environs with the other medical schools and biological science departments that abounded'.

With the appointment of these outstanding scholars, their distinguished successors and the superb faculty they assembled, the School's basic science research enterprise, funded mainly by nationally competitive NIH grants, flourished and expanded. In addition to enhancing the School's image and reputation within the University, and in the biomedical community at large, the presence of a strong basic science research element created a vibrant intellectual milieu for the education of veterinary students, interns, residents, graduate students and faculty at all levels throughout school. Penn became a magnet for

visiting faculty and trainees from veterinary schools around the world.

In 1969, recognising the faculty's quality and commitment to research excellence, the School received a prestigious veterinary scientist training programme grant from the NIH. The grant supports the full cost of a six- to seven-year combined degree (VMD/PhD) programme for selected veterinary students each year. In continuous operation since its inception approximately 40 years ago and still the only NIH award of its kind to a school of veterinary medicine, the programme has produced an extraordinary group of veterinarian-scientists (Table I), including such luminaries as James S. Thomson, now a Professor at the University of Wisconsin, who established the first human embryonic stem cell line in 1998, and recently discovered a method to turn human skin cells into embryonic stem cells. While at Penn, Thomson studied with Ralph Brinster.

Table I  
Current positions of 51 graduates of the VMD/PhD programme

Period	No.	Current positions
1979-2005	29	Academic faculty (6 assistant; 9 associate; 14 full professor; 11 chair, director or dean of departments or schools)
	7	Pharmaceutical or biotech industry (2 directors, 3 presidents)
	6	Postdoctoral fellows, interns or residents
	2	Research staff
	1	Government health agency
	4	Private practice
	2	Other

As the faculty grew in strength and numbers, as new disciplines established themselves, as new opportunities for collaboration between disciplines, departments and other schools emerged and as funding sources were identified, multi-disciplinary units, often called 'Centers', were formed to support and advance the Center's research objectives and training programmes: This flexible approach is

typical of Penn's fostering of collaborative interactions, as it integrates faculty and training programmes across departments and improves collaboration and promotes sharing of core resources. Furthermore, these programmes can broaden to include faculty across the University and can expand or contract as appropriate for school priorities and societal needs. Some of the past and present Centers have focused on the interactions of animals and society, on animal health and productivity and on comparative oncology.

## **2008 and beyond: the future for 'One Medicine – One Health' at the University of Pennsylvania**

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In 2009, the University of Pennsylvania's School of Veterinary Medicine will celebrate 125 years of 'Many Species, One Medicine'®. In addition to looking at the future of integrated biomedical studies implicit in that slogan, we now must turn our attention to the further challenges implicit in the term 'One Health'.

The 'One Medicine' programme, we believe, must be expanded to focus on a crucial challenge confronting our profession. This is the need for translational medicine, understood broadly as translating laboratory science to clinical application (to patients of any species), which is at a crossroads. Will veterinary medicine be able to show that studies in our patients are better for advancing clinical medicine than traditional testing in laboratory animals? With colleagues around the world, we are currently testing the hypothesis that clinical trials in animals with spontaneous disease will make dramatic improvements in moving clinical trials more rapidly from testing in healthy animals to human clinical trials, also improving the ability to detect undesirable effects of drugs or biological agents before wide release. The Veterinary Clinical Investigation Center (VCIC) provides a structure of trained nurses and clinicians who specialise in performing clinical trials. These experts in trial design and

analysis work together with traditionally trained academic clinical specialists. This organisation is fully integrated with the teaching hospital, but provides a means for performing high-volume, high-quality clinical trials that conform to the highest standards, namely: prospective, randomised controlled double-blinded studies to test the hypothesis that a new treatment or intervention is superior to the standard of care for a particular condition. We have been gratified to see increasing interest, not only from the animal health industry but also such major biomedical entities. The potential for comparative oncology is particularly bright. The National Cancer Institute has shown tremendous and laudable interest and appreciation for the potential value of conducting trials in domestic animals with spontaneous cancer as a means to reduce the time to deliver new therapies and possibly identify more thoroughly and correctly than tests in artificially induced cancers in laboratory animals. Penn's Abramson Cancer Center, and NIH-designated Comprehensive Cancer Center that includes faculty across the University, has included such trials in its strategic plan.

What does the future hold? As noted above, the co-curricular veterinary professional and biomedical doctoral training is our signature programme for 'One Medicine' training in comparative biomedical research. We will continue to enhance and expand this programme. In addition to broadening the VMD-PhD, we are exploring many opportunities for master's level training in areas such as translational medicine, bioethics, public health, clinical trials and more.

We are also embarking on training programmes to more efficiently and economically prepare veterinarians for biomedical research – postdoctoral fellowship training for those involved in residency training. As was the case in the 1950s, non-degree research programmes are one means to address the hidden financial drains that deter talented students from pursuing PhD studies. The time spent on minimal training stipends adds to the financial burden and limits career choices. We have identified alternative training

paths to address these issues – with a particular focus on increasing the number of veterinarians engaged in clinical and translational biomedical research. We now offer nationally competitive fellowships in infectious disease, for example, and anticipate also adding programmes in our other key areas of focus for translational medicine, namely: oncology; regenerative medicine and neuroscience. It is interesting and instructive to note that Dean Marshak, in the 1950s, identified the vital importance of quality training in research training, without the uncritical conferring of a PhD. That is, quality training may lead to a fellowship, as often is the case for MD clinician scientists and such an approach may be more efficient and more appropriate. The quality of the programme should be evaluated by the quality of the studies and training, not purely by the degree conferred. Dean Mike Kotlikoff of Cornell's Veterinary College (who, we proudly note, is a Penn Vet graduate), is also highly effectively promoting such fellowship programmes. It is our joint hope that such programmes will become more common and allow more highly motivated veterinarians to pursue their passion for advancing medicine without necessarily sacrificing an additional 6-7 income-producing years after completing their professional and perhaps clinical specialty training.

In regard to the 'One Health' imperative, we are at a pivotal point in the history of disease globally. Will the profession of veterinary medicine take up the proper level of involvement in pressing issues of our time – providing a safe, secure, plentiful source food supply? The term 'One Health' embodies one component of this change, i.e. understanding the ecology of global disease and food production, a different level of integrated study, surveillance and disease prevention are necessary for the global health of humans, domestic species and even wildlife. Penn Vet is helping to pioneer coordinated programmes and is raising the profile of veterinarians making a difference at the global level with the Penn Vet World Awards. The first such award has been given to Bernard Vallat, the

pioneering, dynamic and visionary director of the World Organisation for Animal Health (*Office International des Épizooties*: OIE). The hope and expectation is that such high-profile recognition of a pioneering, visionary veterinarian who has changed the world will highlight the vital role veterinarians play in managing disease and optimising animal health and welfare, in addition to making the world safer for people by improving food safety and biosecurity.

To address this need, we are in the process of providing two new means to train veterinarians in public health issues. The first is to provide a diploma for training during the ordinary four-year training period, in course work and field investigations relevant to food production, food safety and special training in epidemiology and public health. The second is to provide a new training programme to graduate veterinarians, leading to a certificate in global veterinary public health.

In summary, Penn Vet has by design and geography been inherently a training area for veterinarians to obtain integrated medical training for all species, including humans. Penn Vet training and research take advantage of our historical strengths to continue to innovate and lead veterinarians to take their rightful place in the global challenges of improving food safety and production and using our expertise in treating and understanding animal patients to further biomedical research and improve both animal and human health.

In looking to the future, the School will continue to consolidate its position as one of the world's leading veterinary schools by building on its traditional strengths in teaching, research and patient care, while broadening its agenda for excellence to meet the grave challenges of the newly *flat world* where disease, hunger, environmental degradation and war and terrorism threaten civilisation and the very survival of our planet's many life forms. In particular, as the institution where the concept of 'One Medicine' first took root, the Veterinary School welcomes the broader concept of 'One Health' which enlarges our awareness and

appreciation of the inter-relatedness of human and animal health.

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